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*** The above List is prepared from the Patent Records by Mr. T. Morgan, Secretary of the Inventors' Patentright Association, Limited.

Reviews.

THE GAS MANAGER'S HANDBOOK.

"The Gas Manager's Handbook," By THOMAS NEWBIGGING, M. Inst. C. E. London: Walter B. King, Bolt Court, Fleet Street.

This is the Third Edition of a work well-known probably to every gas engineer and manager in practice. The work has been largely re-written and extended, much original matter introduced, and the illustrations that now accompany the text will certainly add greatly to its value.

We should say that the present edition will exceed in usefulness that of the former ones, as it ought most certainly to create a still larger demand, the book forming a very valuable addition to the consulting desk of other engineers than those specially devoted to gas.

SONNET.

On viewing the picture of "An Enchantress" by Madame de Steiger.

On thy sweet face we gaze, Enchantress fair;

And deem that in the secret of thine eyes,
Of dreamy depth, some hidden mystery lies!

There is a grace about thy luscious hair,
There is a beauty in thy form so rare;
An occult beauty, beneath subtlest guise,
Which wins us with a love to idolize:

Tho' fraught with charms the skilled in sorcery wear!

Around thy neck the mystic blue-stones give

A glimmer to thy spells for subtle arts;
And in thy hand, an urn, within which live
The hidden secrets that thy power imparts.

As Art extols thee, fair Enchantress! thus
Thy living Picture hath enchanted us.

HENRY GEORGE HELLON.

Correspondence.

LIGHTHOUSE ILLUMINANTS.

TO THE EDITOR OF THE SCIENTIFIC REVIEW.

SIR,—From the statement of the President of the Board of Trade in the House of Commons, it appears that the disputed question as to whether gas or oil is the better illuminant for lighthouse purposes is to remain unsolved. Not apparently from any want of assistance on the part of the Board of Trade, but from misunderstanding and dissensions amongst some of the members of the proposed committee.

It seems to my directors a pity that a matter of such great importance to the Mercantile Marine should be left in this undecided and unsatisfactory condition, and as owners of Sir James Douglass's Patent Burners, which my directors believe to be superior to all others, they are prepared to challenge Mr. Wigham and his champion, Professor Tyndall, to a trial of the Gas Burner invented by Mr. Wigham, against the Oil Burner, or Gas Burner invented by Sir James Douglass, his Patent being alike applicable to oil or gas, the merits of each to be tested and reported upon by Mr. A. Vernon Harcourt; if he will accept the position, and the expenses of each side to be borne by themselves, or, if Professor Tyndall prefers it, the owners of the inferior burner to pay the whole of the expenses attending the trial.

I may add my directors attach little commercial value to the result of any trial of Sir James Douglass's larger burners. They are mainly suitable for lighthouse purposes, and it is well known that in selling his Patents to this Company, Sir James specially reserved to all lighthouse authorities in the United Kingdom the right to use his burners free of all cost.—I am, &c.,

R. T. STRANGMAN, Secretary.

The Improved Gas and Oil Burners Company, Limited.

PURIFICATION OF HAY.

In a climate so variable as is possessed by this country, great difficulties are encountered by the practical farmer, arising from the liability, on account of excessive moisture of the hay in stock becoming mildewed or musty. Every year large quantities representing great value, are in this way rendered unfit for the feeding of cattle, and for the most part this hay is rendered valueless, except so far as it may be used for bedding purposes.

We have just had brought under our notice an invention for purifying hay and other fodder after it has become mildewed, and which discovery appears likely to become of great value to this and other countries similarly situated. The invention is due to Mr. Charles Perkin, a well-known Cheshire farmer, who has been impelled to experiment in this direction, from losses of hay experienced during recent wet seasons. We have seen some of the hay operated upon and the result of our examination was highly satisfactory, as it would have been utterly impossible to know that such had ever been mildewed from mere examination, as it was not only perfectly free from the parasitic growth, but had a high class aroma which alone would have testified to its good condition.

The treatment consists in a novel application of steam under pressure, by means of which the mildew is entirely destroyed. The method is exceedingly simple, and the needful apparatus is connected to the ordinary portable steam boiler of the agricultural engine.

Whatever may be the value of ensilage to the British farmer, we certainly think the hay crop in future may be saved by means of Mr. Perkin's invention, from the scourge of mildew or must.

W. G.

MATTER AND FORCE.

(Continued from Page 71.)

ANOTHER form of force, universal in matter, is Gravitation.

It is somewhat surprising what a number of difficulties present themselves to some minds with regard to the universality of this force. We have heard amongst many similar, the question propounded, how is it that whereas a stone falls to the earth, substances like smoke rise upwards? Now it would seem that all persons should at once perceive that it is exactly because gravitation acts equally on every separate atom of matter, that this apparent contradiction takes place. The earth draws towards itself the atmosphere as well as the smoke, and as the air at the earth's surface is denser, and thus heavier than the smoke, it is consequently attracted with greater force, the air pushing the smoke out of the way, and forcing it upwards from the earth. But see what takes place when the smoke is pushed so high that it reaches atmosphere which is as light as itself. It is then attracted to the earth equally with the air which surrounds it, and floats serenely on the heavier strata. The same thing takes place if we drop a stone into a basin of water, for the stone forces out of the way its own bulk of the liquid; and as the water is confined within the sides of the vessel, it is compelled to rise higher in level, to enable it to find space for itself. Now if we liken the air to the water in the basin, and the smoke to a cork set at liberty at the bottom, the whole phenomenon becomes clear. And yet we have even professed scientific thinkers coming to the conclusion that it is possible that there exists between the planetary bodies an attenuated atmosphere composed of the same substances as exist near to the earth, and of uniform density. This is surely impossible, unless it can be demonstrated that the matter, of which such an atmosphere is composed, has no gravitating power within it, and thus is distinct from, and is not capable of being acted upon by the other matter of the universe.

We ourselves are by no means sure that such a supposition is as wild as at first sight it may appear. We know that we find attractive and repulsive forces inherent in matter. And that they may be accounted for by the theoretic existence already explained, of these dual forces in each atom of matter. But we also can see clearly that a slight modification of this theory, whereby we might suppose dual matter would not only explain the phenomena of attraction and repulsion, but would enable us to bridge over the difficulty of the transmission of force through apparently empty space. Thus if we were to accept the existence of both positive and negative atoms of matter, it would follow that one kind would tend to aggregate while the other would not; and we could thus fill the interstellar space with a material ether which would be capable of transmitting light waves, and even gravitation waves—if such be transmitted in wave form; yet at the same time offer no friction whatever to the motions of the heavenly bodies in so-called space. All this is, however, merely suggestion, and is only useful as indicating a possible field for research.

To return to the consideration of gravitation, we know that the seat of attraction is at the centre of a mass of matter which thus becomes a neutral point, and that like of all other forms of force, it may be said that reaction is equal to action. So that, not only does the earth attract a falling stone, but the stone in proportion to its mass attracts the earth. It follows, therefore, that the stone in descending does not travel quite so far as in ascending, inasmuch as the earth goes a short distance to meet it. Of course in the case of any stone we could deal with, the distance would be so small as to be utterly inappreciable; still it is none the less true, and has been most forcibly

illustrated by the saying that, "the kick of a fly moves the whole globe."

The earth's centre of gravity being the neutral point must not induce the supposition that the lower we descend into the bowels of the earth the stronger the power of attraction towards the centre becomes, for the very reverse is the case. The lower we go the greater is the gravitating force of those portions of matter above, which attract by re-action towards the surface, until, if the centre be reached, the opposing forces would balance each other, and a body would there no more incline to fall one way than another. On the top of high mountains the force again diminishes as we recede farther and farther from the centre. This is well shown by a body weighing 500lbs. at the sea level only weighing 499 lbs. at the top of a mountain 4 miles high. To demonstrate this, of course it is necessary to use a spring balance, as otherwise no difference is observable. We find the power of gravitation increases exactly in proportion to the quantity of matter contained in the body—that is to say: a body with twice as much matter will attract with twice as much force, and one with ten times as much with ten times the force. But it has not the same direct proportion with regard to distance, for the force decreases as the square of the distance increases.

To make this point quite clear we will suppose a case. Let us take a globe of matter say 8 miles in diameter, this will measure 4 miles from the centre to the surface. Now if we place a body at a distance of 4 miles away from its centre, the attraction would be 4 times less than it would be at the surface. And if we removed the body to another 4 miles distance, that is 12 miles from the globe, it would be attracted with 9 times less force than at the surface. It will thus be seen that if we ascertain the number of semi-diameters contained in the distance the body is from the globe's centre, the square of that number will give the number of times less force exerted on the body than at the surface. Consequently, if we remove a body to an indefinite distance from such a globe the force of attraction becomes very small indeed, and as gravitating force is only another term for weight, it follows that if a body of no matter what density were removed to an indefinite distance from any other, such a body would have no weight whatever. We may put the same truth in another form; namely, if all the matter of the solar or sidereal systems were aggregated together and none other existed in infinite space, there would then be no manifestation of weight in the total mass, although objects within or at the surface would have a weight which would depend upon the size and density of the whole. We thus see that weight is simply the action of one body toward another, and is a resultant merely of interaction amongst adjacent and distant particles. Therefore to determine the weight of any body in space, two things are requisite; first, the distance from its attracting centre? and second, the distance between the particles of which it is composed, or in other words its density.

There is another experiment which shows the diminishing power of gravity as the centre of the earth is left. We refer to the action of the *Pendulum*. Now the pendulum is drawn downwards by the force of gravitation, but in descending follows the law of all falling bodies, and so obtains an impetus which raises it to almost the same height on the other side. It does not reach the same height because of gravitation pulling it downwards on the supporting centre upon which the pendulum swings, and thus, producing friction, gradually shortens the motion and brings the instrument to rest. It is for want of seeing this clearly that so many otherwise clever mechanicians have followed so persistently and foolishly the idea of perpetual motion.

Gallileo Gallilei discovered that a pendulum takes up the same length of time to pass through its arc, whether such arc be longer or shorter (within certain limits), and whether the weight be more or less, that is to say, so long as the weight is the same distance from the centre. This is called the law of *Isochronism*.

We may at once see that if gravitation is less at a distance from the earth, the pendulum will be drawn down with less force, and so take longer time to make its oscillation. In practice this is demonstrated to be really the fact, the pendulum being found to vibrate more slowly the farther it is removed from the centre of the globe.

It will be well here to remark that we can have no conception of any force being in existence except by *motion*. It is quite true there are cases where we know force exists, and yet where motion is in no way visible to our senses, as for example: Suppose to a block of stone two horses of exactly equal strength were hooked in precisely opposite directions, and supposing equal forces exerted by the horses, the stone will not appear to be moved, but will remain in equilibrium, as it is termed. In a similar manner we are utterly unconscious of the pressure exerted upon us by the atmosphere, which is well known to be about 15lbs. to the square inch, for the reason that there is exactly the same pressure within us as without, thus rendering it possible for the most delicate things to exist without injury. Take for instance the common egg-shell after the egg has been drawn or blown out. We have here a very fragile form of matter with all the atmospheric pressure around it, but with an equal pressure within, which renders the shell as free from injury as if no pressure were exerted upon it. But suppose we close up one end of the shell and apply the air pump to the other, suddenly pumping out the air. We find the shell instantly crushes up from pressure of the external air, just as if it had been crushed up with the hand.

There is here, in fact, a very important question raised. Is force destructible or capable of being annihilated by an opposing force? Science has in various ways definitely and conclusively answered this question, and it has been completely demonstrated that, given a force to be in existence, it will be and has been of equal power for ever in one form or another, and there is no possible destruction of that force. We may by opposing any equal force place it in equilibrium as in the cases previously referred to, whereby it may cease to affect our senses, but it is all the time stored up in potential form, so that upon the liberation of the force on one side, the other will operate at any distance of time with just the same power as at first.

As there is no demonstrator of force but motion, it follows that as far as we are concerned force and motion are synonymous. Taking this standpoint the question naturally arises, where then is the motion in the stone when the two horses are pulling equally in opposite directions? This query compels us to confront the latest discoveries of modern times, namely, those connected with what is termed molecular force or motion. It will be remembered that we arrived some little time back at a point where we stated that no two atoms ever touch each other. Now this can only be so providing there is some resisting force which keeps them apart. What is this force which thus balances the cohesive action of the particles of matter, and prevents their rushing together into one huge whole? The answer given by Science to this is that each of these atoms has at least one (and probably more than one), proper motion of its own, which, although we cannot see, is demonstrated to our senses in the form of *heat*. Thus the quicker the motion of the particles the hotter they appear to our sense of touch

and the farther apart they become separated.

Now in the case of the two horses pulling at the stone in opposite directions, the *motion* is communicated to and distributed amongst the atoms composing the block, causing an increase in the speed wherewith the particles move, and so enhancing the heat thereof, either sensibly or latently according to circumstances.

We know this is somewhat startling to some minds, but it is strictly analogous to the fact that the orbital motion of the planets prevents their absorption into the sun; and it is capable of partial demonstration by experiment.

Iron and other metals are made hot by hammering, as they are also by pressure in a powerful hydraulic press. Heat has over and over again been shown to be simply a mode of motion, which we think is seen perhaps the best in the action of the steam engine. There we have the heat of the fire first communicating itself to the water in the boiler, which in turn becomes converted into steam having an expansive force causing it to be capable, when liberated, of a motion such as is required to move forward the piston, and through that to drive the fly wheel of one of the most wonderful mechanical agents of this age.

W. G.

(To be continued.)

ANIMALS AS DOCTORS.

M. G. DELAUNAY, in a recent communication to the Biological Society, observed that medicine, as practised by animals, is thoroughly empirical, but that the same may be said of that practised by inferior human races, or, in other words, by the majority of the human species.

Animals instinctively choose such food as is best suited to them. M. Delaunay maintains that the human race also shows this instinct, and blames medical men for not paying sufficient respect to the likes and dislikes of the patients, which he believes to be a guide that may be depended on. Women are more often hungry than men, and they do not like the same kinds of food; nevertheless, in asylums for aged poor, men and women are put on precisely the same regimen. Infants scarcely weaned are given a diet suitable to adults—meat and wine, which they dislike, and which disagree with them.

M. Delaunay investigated this question in the different asylums of Paris, and ascertained that children do not like meat before they are about five years of age. People who like salt, vinegar, &c., ought to be allowed to satisfy their tastes. Lorain always taught that with regard to food people's likings are the best guide. A large number of animals wash themselves and bathe, as elephants, stags, birds, and ants. M. Delaunay lays down as a general rule that there is not any species of animal which voluntarily runs the risk of inhaling emanations arising from their own excrement.

If we turn our attention to the question of reproduction, we shall see that all mammals suckle their young, keep them clean, wean them at the proper time, and educate them; but these maternal instincts are frequently rudimentary in women of civilized nations. In fact, man may take a lesson in hygiene from the lower animals.

Animals get rid of their parasites by using dust, mud, clay, &c. Those suffering from fever restrict their diet, keep quiet, seek darkness, and airy places, drink water, and sometimes even plunge into it. When a dog has lost its appetite, it eats that species of grass known as dog's grass (*chiendent*), which acts as an emetic and purgative. Cats also eat grass. Sheep and cows, when ill, seek out certain herbs. When dogs are constipated they eat fatty substances, such as oil and butter, with avidity, until they are

purged. The same thing is observed in horses. An animal suffering from chronic rheumatism always keeps, as far as possible, in the sun.

The warrior ants have regularly organized ambulances. Latreille cut the antennæ of an ant, and other ants came and covered the wounded part with a transparent fluid secreted from their mouths. If a chimpanzee be wounded, it stops the bleeding by placing its hand on the wound or dressing it with leaves and grass. When an animal has a wounded leg or arm hanging on, it completes the amputation by means of its teeth.

A dog on being stung in the muzzle by a viper was observed to plunge its head repeatedly for several days into running water. This animal eventually recovered. A sporting dog was run over by a carriage. During three weeks in winter it remained lying in a brook, where its food was taken to it: the animal recovered. A terrier dog hurt its right eye; it remained lying under a counter, avoiding light and heat, although habitually it kept close to the fire. It adopted a general treatment, rest and abstinence from food. The local treatment consisted in licking the upper surface of the paw, which it applied to the wounded eye, again licking the paw when it became dry.

Cats also, when hurt, treat themselves by this simple method of continuous irrigation. M. Delaunay cites the case of a cat which remained for some time lying on the bank of a river; also that of another cat which had the singular fortitude to remain for forty-eight hours under a jet of cold water. Animals suffering from traumatic fever treat themselves by the continued application of cold water, which M. Delaunay considers to be more certain than any of the other methods.

In view of these interesting facts, we are, he thinks, forced to admit that hygiene and therapeutics, as practiced by animals, may, in the interests of psychology, be studied with advantage. He could go even further and say that veterinary medicine, and, perhaps, human medicine, could gather from them some useful indications, precisely because they are prompted by instincts which are efficacious in the preservation or the restoration of health.—*British Medical Journal*.

PHOTOGRAPHING THE SOLAR CORONA WITHOUT AN ECLIPSE.

By WILLIAM HUGGINS, D.C.L., LL.D., F.R.S.

My first attempts at photographing the corona were made with photographic lenses; but uncertainty as to the state of correction of their chromatic aberration for this part of the spectrum, as well as some other probable sources of error which I wished to avoid, led me to make use of a reflecting telescope of the Newtonian form. The telescope is by Short, with speculum of 6 in. diameter, and about 3½ ft. focal length. A small photographic camera was fastened on the side of the telescope-tube, and the image of the sun, after reflection by the small plane speculum, was brought to focus on the ground-glass. The absorptive media were placed immediately in front of the sensitive film, as in that position they would produce the least optical disturbance. Before the end of the telescope was fixed a shutter of adjustable rapidity, which reduced the aperture to 2 in. This was connected with the telescope-tube by a short tube of black velvet for the purpose of preventing vibrations from the moving shutter reaching the telescope. On account of the shortness of the exposures, it was not necessary to give motion to the telescope.

It was now necessary to find an absorptive medium which would limit the light received by the plate to the portion of the spectrum from about G to H. There is a violet (pot) glass made, which practically does this. I

had a number of pieces of this glass ground and polished on the surfaces. Three or four of these could be used together, castor-oil being placed between the pieces to diminish the reflection of light at their surfaces. Some inconvenience was found from small imperfections within the glass, and it would be desirable in any future experiments to have a larger supply of this glass, from which more perfect pieces might be selected.

In my later experiments I used a strong and newly-made solution of potassic permanganate, in a glass cell with carefully polished sides. This may be considered as restricting the light to the desired range of wave-length, since light transmitted by this substance, in the less refrangible parts of the spectrum, does not affect the photographic plates.

Different times of exposure were given from so short an exposure that the sun itself was rightly exposed to much more prolonged exposures, in which not only the sun itself was photographically reversed, but also the part of the plates extending for a little distance from the sun's limb.

Gelatine plates were used, which were backed with a solution of asphaltum in benzole.

After some trials I satisfied myself that an appearance peculiarly coronal in its outline and character was to be seen in all the plates. I was, however, very desirous of trying some modifications of the method described, with the hope of obtaining a photographic image of the corona of greater distinctness, in consequence of being in more marked contrast with the atmospheric illumination.

Our climate is very unpropitious for such observations, as very few intervals, even of short duration, occur in which the atmospheric glare immediately about the sun is not very great. Under these circumstances I think it is advisable to describe the results I have obtained without further delay.

The investigation was commenced at the end of May of this year, and the photographs were obtained between June and September 28.

The plates taken with very short exposures show the inner corona only, but its outline can be distinctly traced when the plates are examined under suitable illumination. When the exposure was increased, the inner corona was lost in the outer corona, which shows the distinctly curved rays and rifts peculiar to it.

In the plates which were exposed for a longer time not only the sun, but the corona also, is photographically reversed, and in these plates having the appearance of a positive, the white reversed portion of the corona is more readily distinguished and followed in its irregularly sinuous outline than is the case in those plates where the sun only is reversed, and the corona appears as in a negative, dark.

THE GREAT RED SPOT ON JUPITER.

By G. D. HISCOX.

THE phenomenon of the now famous red spot upon the surface of the planet Jupiter has drawn the attention of observers to an apparent condition of internal planetary activity not heretofore observed, or only beginning to be seen through the means of the great advance in telescopic power and definition lately required.

The intensity of this spot seems to be now vanishing after a duration of about three and a half years, during which time observations have been made of its physical appearance and for the purpose of detecting any local or relative change of position. Also for the purpose of ascertaining the period of rotation of the planet, as compared with the period heretofore assigned from observations of its cloud spots.

The two periods of rotation are observed to vary about 5½ minutes; giving the rota-

tion by the cloud spots as 9 h. 50 m. to 9 h. 50 m. 9 s., while the rotation by the great red spot was found to be 9 h. 55 m. 34 s.

The times given for rotation by observations upon different cloud spots also vary enough to give us, together with the varying contour of the cloud belts, strong evidence that what we see of the planet Jupiter is not the body of the planet itself, but rather a vast sea of cloud, possibly thousands of miles in depth, kept afloat by the intense heat of the body of the planet.

From the well known laws of circulation of gases, vapours, and cloud masses, as illustrated by the circulation of the atmosphere, together with the progress and direction of the great storms, cyclones, and tornadoes upon the earth, and as are beginning to be elucidated in the cyclonic action of the sun spots, according to Faye's theory, which best meets the conditions deduced from spectroscopic observations; we cannot do otherwise than come to the conclusion that the solid body of Jupiter has never been seen—that our observations are only of the surface of vast envelope of cloud, that by its rapid rotation is constantly creating and keeping up an intercirculation, such as our trade winds and equatorial doldrums, upon a vast scale.

In this connection we have only to carry our minds back to the beginning of the Azoic age of our world, and to imagine the surface just crusting over and still red hot in zones, with our entire oceans hanging as a vast cloud above, and precipitating its dense vapours as rain upon the hot and hissing surface. It was then that the activity of natural forces were at their height. It was then that the upheaval of the intensely heated masses from below met the cloud bursts from above, and produced the same class of phenomena that has lately been observed, upon a vastly larger scale, upon the planet Jupiter.

If, in view of the low density which has heretofore been given for Jupiter, we can reasonably accept an atmospheric or cloud depth of eight or ten thousand miles, the apparent great diameter of the red spot may be assumed as only the irradiation to, and illumination of, the deep cloud stratum by an igneous mass, much smaller than the apparent size of the red spot, as we see it from the earth.

The size of the great spot, 26,000 by 8,000 miles, may be, for a planet 88,000 miles in diameter, only the illumination of a reasonable upheaval of the highly heated mass of the interior corresponding with the remains of such masses upon our earth.

ON TEACHING ORGANIC CHEMISTRY.

By Prof. EDWARD J. HALLOCK.

If chemistry in general is a difficult subject to teach and a dry one to learn, this is especially the case with that branch known as organic chemistry. The necessity of teaching it in high schools and colleges is beginning to be felt, but how it is to be taught it is more difficult to say. As usually taught, it is a mere matter of memorialisation; a list of complicate chemical formulæ with a string of unpronounceable polysyllabic names is presented to the learner, and he is invited to swallow them first, and take the chances of being able to digest them at some future time. Text books on organic chemistry are of two kinds, the one filled with a collection of facts, figures, and formulæ; the other devoted to theorising, and stuffed full of hypotheses, with algebraical symbols and geometrical diagrams to illustrate how elements may perhaps combine. Admitting the insufficiency alike of oral and text book teaching, organic chemistry has been assigned to the laboratory, and, whether aided by lectures or not, the student gets his first insight into its mysteries there. In this, organic chemistry scarcely differs from any other

branch of chemistry. The composition of bodies may be learned by rote, their nature and properties can only be learned by contact.

A very simple laboratory will suffice for all except the most difficult operations of organic chemistry, but it needs to be quite differently arranged from those now in use for inorganic work. One of the plainest and simplest laboratories for organic research, and yet one of the most efficient, is that of Prof. Ad. Wurtz, in the Ecole de Médecine, in Paris. In all laboratories gas must be abundant and under sufficient pressure, which can usually be obtained if large service pipes are used. Water must be plentiful and well distributed everywhere, so that distillations can be carried on conveniently at all times, and in many places, out of doors as well as in. Water pumps and aspirators are desirable, and a "bomb-proof" indispensable. The usual sinks, draughts, hoods, water and mercury baths, combustion furnaces, blast-lamp, &c., are, of course, required, and a good chemical balance. A considerable quantity of glass and porcelain will be required, but of quite another sort from that used in other laboratories.

To obtain the best results there should be a teacher to guide and direct the work. This is not generally the case, the student being thrown almost entirely upon his own resources. Of course, boys do not begin organic work until they have reached the years when they ought to have discretion, but even then, in a new field, it is well to have a guide. Good chemists are rarely good teachers, and *vice versa*, hence the difficulty of securing the right sort of men for these places. Generally the position is a mere stepping stone, and is only held until a better offers, or else the teacher is too occupied with other work to give any attention to the student. We know whereof we speak, when we say that this is an evil not confined to any particular country or nation. It promises, however, to diminish in this country as the number of organic chemists increases.

Having obtained a suitable laboratory, with or without a teacher, it remains for us to decide upon some systematic line of work to be done. Here, again, our experience in other laboratories is of comparatively little assistance, for different subjects require different treatment. The student of inorganic chemistry usually begins with qualitative analysis, in which he learns the properties of the leading metals and their salts, and, in fact, learns to recognise most of the elements when combined. In organic chemistry most compounds consist of but two or three elements, and qualitative analysis has scarcely any application to organic chemistry. Testing for proximate principles, like starch, gum, and sugar, or learning to recognise the various alcohols, ethers, and acids, would be a valuable drill, but proximate organic analysis is yet in its infancy, and has not been reduced to a system that permits of its being carried out on the plan of mineral analysis. At present a qualitative analysis of an organic mixture often baffles the skill of the most experienced analyst. It is evident that it would be unfair to set a beginner at it.

In mineral chemistry the blow-pipe often does good service and shortens many a tedious test; in organic chemistry it has no use except to determine mineral elements. The flame test for chlorides, bromides, and iodides is the only one in common use.

The quantitative analysis of an organic body may be either proximate or ultimate. The first applies only to mixtures, like finding the amount of sugar and alcohol in wines; the second only to simple substances, such as finding the percentage of carbon and hydrogen in alcohol. The latter is a simple operation, and, being done in the "dry way," is well adapted for an initiatory exercise for beginners. It is exceedingly important that a chemist be able to make an accurate and reliable ultimate analysis, for which

purpose he must make a sufficient number of "combustions" of pure substances, both solid and liquid, such as sugar, oxalic acid, alcohol, benzol, turpentine, chloroform, ferrocyanide of potassium, urea, &c., to gain experience in it. Whether this shall be the first exercise given him to do will depend on the director of the laboratory, who should also take into account the weather, and allow these analyses to be made in winter or early spring.

In some American laboratories students take a preliminary course of experiments before taking up qualitative analysis. This usually consists in making oxygen and other gases, in preparing nitric and other acids, in purifying and crystallising metallic salts, and in thus learning chemical manipulations. This course is the only one performed in the inorganic laboratories that can be closely imitated in the organic laboratory.

In most of the German laboratories the student is set to prepare various organic compounds, ethers, esters, or salts, so as to become acquainted at the same time with their properties, and with what is equally important, the methods of making them.

A little book, by H. C. Jones, has recently appeared, in which are described a number of suitable experiments in organic chemistry, that may be safely performed by the student at his desk. This book will be found useful to students that have no teacher, and prove convenient for teachers who have not the ingenuity to invent a similar course. It is not necessary to follow the order of the book; the experiments can be varied to conform with any text book that the teacher prefers. Unfortunately, no complete work exists giving the best method of making all sorts of organic compounds, but assistance can be had from Attfield, the U. S. Dispensatory, Watts' Dictionary, and especially the original papers of the men who discovered the substance, when they are accessible.

After the student has been through a course of simple organic experiments, making hydrocarbons, alcohols, and ethers, and preparing the most useful reagents, such as acetyl chloride, methyl and ethyl iodides, absolute alcohol, ethyl sulphates, and the like, it is well to take up a special class of reactions. The most useful of these are nitrification and reduction. Take benzol, for example, and convert it into nitro-benzol, then reduce this to amido benzol (aniline), and afterward convert the latter into rosanilin. Instead of benzol, phenol, or other aromatic substance can be treated in like manner. This series of operations is very instructive. To undertake the investigation of a new and unstudied substance without the advantage of this preliminary acquaintance with methods is like trying to make an analysis of an unknown substance without ever having analysed a known substance. It is like a man who attempts to invent a locomotive without ever having seen one; men of extraordinary genius succeed, but others meet discouragement at every step, though they may succeed at last.

An excellent method pursued in some laboratories consists in allowing a student who has satisfactorily performed the various operations above described, to repeat the classical investigations of some distinguished chemist, such, for example, as Wurtz's discovery of glycol, Hofmann's preparation of the organic ammonias or mustard oils, or the equally well known investigations of Kolbe or Kekulé. Taking the published papers of these men, the young chemist repeats each step as if engaged in an original research of his own. Thus he meets with each of the obstacles encountered in an original investigation, but here he has the advantage of knowing that they can be overcome, because in this very case they have been conquered, and the combination that he sets out to make is a possible.

Although this will seem a tedious route for one who is in a hurry to distinguish himself

by original brilliant discoveries, he will find it the old story of the hare and the tortoise.

In some organic laboratories where technical instruction is the special aim, large apparatus, steam boilers, and autoclaves are at the disposal of the student, who repeats manufacturing operations on a moderate scale, using several pounds of material, so as to gain an insight into the practical workings of a process. This is not feasible in a college course, but very useful in a technical school, for it often happens that operations which work nicely in a test tube fail to prove profitable on a manufacturing scale; while on the other hand, owing to the use of steam heat, high pressure, vacuum pumps, and other powerful apparatus, some chemical operations go on more smoothly on a large scale than on a small one. A hundred-weight of starch can be converted into glucose more quickly and easily in the factories than an ounce can be in the laboratory. The preparation of artificial salicylic acid from carbolic acid is not easily performed as a laboratory experiment, but is a grand manufacturing success. As a rule, the preparation of artificial dye stuffs from aniline, carbolic acid, anthracene, &c., can be accomplished on a large scale or a small one with nearly the same facility, so that a patent is frequently taken out and the process sold for a large sum when less than an ounce of the dye has actually been made. It is not advisable, however, when attempting anything new, to work on a very small scale. When Hofmann began his investigation of bases in coal tar, he started off with half a ton of raw material, and from that he obtained four pounds of the crude bases, less than half of which was aniline, the substance destined to revolutionise the colour industry.

When a student has familiarised himself with well known reactions and operations, and wishes to enter upon an original research, having selected a subject—and in this he will need the aid of a widely read chemist—he must next ascertain what has already been done in that line. This involves a somewhat tedious search through all the literature of the past, nor is the literature of organic chemistry a meagre one. A single chemical society, that of Berlin, issues two volumes of transactions, of one thousand pages each, every year. More than half of this is devoted to original work on organic subjects. The *Journal of the London Chemical Society* is equally voluminous, besides which numerous *Annalen* and *Annales* are to be consulted, as well as all the year books in different languages, so that access to a large scientific library is absolutely essential, and several months may be consumed in this preliminary work, but it will be time well spent.

That organic research is attended with considerable expense will be evident. If the raw material is cheap, or is a waste product, as is often the case, it must be put through a great number of operations before anything new can come out of it. The inhabitants of an old and densely populated country must travel far before he can commence the exploration of any unknown wilderness, passing over many miles of well beaten roads. So each successive investigator has farther to travel than his predecessors before he can reach an untrodden field. The way is long and the materials used must in most cases either be imported or prepared by the chemist himself. Occasionally some one, more fortunate than the rest, discovers a little wilderness near at home where he can labour at small expense and with fair chances of success. As a rule, however, poor men do not succeed well in their investigations of the mysteries of organic chemistry. But there will soon be work enough of a practical nature, in analytical and manufacturing laboratories, with fair salaries, let us hope, to occupy those chemists who, having less originality and genius for investigation, are less likely to succeed in that than in other departments.

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AND

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Proceedings of the Institute.

The Institute being now out of session, there is nothing to report.

Monthly Notices.

Prof. Morris has presented his valuable geological library to University College, London.

The Rolleston Memorial Fund, amounting to £1,200, has been handed over to the University of Oxford for the foundation of a prize for original research in animal and vegetable morphology and physiology, to be awarded every two years.

Subterranean Telegraph Lines in France.—The *Moniteur Industriel* states that more than 700 miles of subterranean telegraph lines are completed in France, and that 1,300 miles are in course of construction, and will be completed by the end of this year.

Influence of Reduced Atmospheric Pressure upon Animal Life.—MM. Frankel and Geppert find that at pressures corresponding to an altitude of 3,800 to 4,900 metres the proportion of oxygen in the blood is not diminished. At $\frac{1}{2}$ atmosphere, corresponding to an altitude of 8,800 metres, the arterial oxygen is reduced by one-half. The formation of carbonic oxide is reduced, but not in a corresponding proportion. The decomposition of albumenoids in the body, and consequently the excretion of nitrogen, are increased. The loss of blood from the mucous membranes is not due to direct mechanical action.

Studies on Milk.—H. Struve comes to the conclusions that human milk and cows' milk contain the identical albumenoids. Human milk contains, however, a smaller proportion of albumenoids, and especially of caseine. All the albumenoids held in solution in milk can be separated by dialysis (with chloroform water) from the undissolved caseine and from the butter. A part of the undissolved caseine forms the covers of the milk-globules, and is separated out in the cream; the other portion remains in the skim-milk. The milk-globules swell up if shaken with ether. The digestibility of any milk is inversely as the quantity of caseine which remains in the skim-milk. Hence Dr. Biedent's suggestion that only cream should be used for the earliest nourishment of young children brought up by hand is perfectly justified. The caseine of human milk, as well as of cows' milk, has always an acid reaction. In human milk there is only a small quantity of butter in a free state.

Death of Mr. Spottiswoode.—We regret to announce the death of Mr. Spottiswoode, LL.D., President of the Royal Society, which took place on Wednesday morning last at a quarter past eleven o'clock. Mr. Spottiswoode was born in January, 1825, and was consequently in his fifty-ninth year. He was educated at Dr. Buckland's school at Laleham, and afterwards at Eton, and at Harrow under Dr. Wordsworth. He entered Balliol College, Oxford, in 1842, graduated B.A. as a first-class in mathematics in 1845, and gained university mathematical scholarships in 1846 and 1847. On leaving Oxford he took the management of the business of the Queen's printer, but he continued his studies in mathematics, philosophy, and languages; was elected a Fellow of the Astronomical, Royal, Geographical, Asiatic, and Ethnological Societies, and of the Society of Arts. In 1857-58, Mr. Spottiswoode was Public Examiner in Mathematics at Oxford, and he has acted as examiner under the Civil Service Commission, for the Society of Arts, and for the Middle Class Schools. He was appointed Treasurer of the Royal Society in 1871, and was elected President in 1878. He was also elected President of the British Association in the same year, at the Dublin meeting, when the University of Dublin conferred on him the honorary degree of LL.D. A similar degree had in 1871 been conferred on him by the Edinburgh University.

Copper and Lead from a Hygienic Point of View.—A. Gautier shows that copper is little calculated to produce mortal results. The solubility of most of its salts, their marked colour, nauseating taste, and emetic action give at once warning. The salts of lead, on the contrary, have no pronounced taste, or are even sweetish. They are in general colourless. If introduced into the system there is no alarming effect until the nervous centres, the liver, and the blood have become interpenetrated with the poison. All foods sold in tins, especially of a fatty nature, public water-supplies, wines, beers, effervescing drinks, the glaze of earthenware, enamels, and especially culinary utensils lined with tin, may introduce lead into the system. M. Gautier calculates that every Parisian absorbs daily $\frac{1}{2}$ m.grm. of lead salts.

THE SCIENTIFIC REVIEW

AND

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JULY, 1883.

DANGEROUS EXITS.

THE providing satisfactory means of safe exit from our places of public amusement would seem to be as far from realisation to-day as at any time within the last decade; although during that period the pressing necessity for improvement has been a constant theme of comment, not only in scientific journals, but, to a large extent, in the ordinary newspapers of both town and country.

We must surely be a people but slow to learn, or after so much has been said on the subject, a catastrophe like unto the appalling one at Sunderland would have been, at this time of day, utterly impossible.

There is a terrible similarity in all such events, whether brought about by the outcry of fire or other cause of panic, which at once points the specially weak spot in the construction of many of our public halls, theatres, and places of worship. It unfortunately seems to be firmly fixed in the minds of those who are responsible for this state of things, to an extent comparable only with the holding of a religious dogma, that, no matter what may be the size of a building, or its capacity for holding human beings, the narrowest of passages is quite sufficient to allow of exit and entrance. This arrangement alone is often the cause of much loss of life; but as if such did not offer chances enough for accident, these gaspipe passages are frequently converted into veritable death-traps by the erection of doors or turnstiles, which sometimes are of the most likely description for causing calamitous results.

If the general public could have the means of knowing how often a single writer has occasion to call attention, in different parts of the country, to this deplorable state of things, we feel convinced that legislative interference, and that of a very stringent character, would very speedily be insisted upon.

It is indeed doubtful whether any real or adequate improvement will ever take place until the whole subject is placed under the direct control of the law, and a proper system of official inspection adopted; for even in cases where the original construction might be all that could be wished, it is very possible that alterations would often be made which, if not interfered with, might be productive of the most dire results.

With regard to the Sunderland case, it teaches again the lesson that, as human nature at present exists, it is liable, in masses and on the slightest provocation, to mental panic. No good whatever will come by ignoring this fact; for persons possessing the strongest minds find they experience some little difficulty, when with a crowd, in overcoming this unpleasant tendency.

The proper thing, therefore, is to make due provision for such a condition of things, and to institute some means whereby it shall be compulsory for the owners of public places of entertain-

ment to provide, whether it involves reconstruction or not, a simple and efficient means of exit, which would render the sacrifice of hecatombs of children to the twin gods Stupidity and Ignorance utterly impossible.

If there were any real difficulty in the way of accomplishing so desirable an end, there might be some excuse for the slow progress that has been made in this direction; but so far as we can see, it is solely the supineness of the people which has permitted up to now the construction of our public buildings on principles subordinated to a wretched economy of land and materials, involving an ascertainable and periodical loss of valuable human life.

The passages of nearly all our places of amusement are far away too narrow, and have too many twists and turns therein. The width of such ought in most cases to be fully double what they are at present, and should in all cases be either straight or formed with curves of long radius. Anything like sudden bends therein should be avoided as a pestilence, and no barrier what ever should be permitted from end to end. The outer door should be of the same width as the passage itself, and the pernicious and disgraceful system of allowing crowds of persons to congregate at such doors, for the purpose of crushing into a building, ought to be abolished at once. Nothing can be easier, as the opening of doors earlier, or the dispersion of a crowd by the police at the moment of opening, would prevent all the evil, and the stationing of officials at the needed points would be more effectual than the clumsiest of wooden barriers, without a single element of danger.

There would thus need doors only at the entrances of the building and to the auditorium, all of which should be made to swing freely each way, and only the outer doors provided with any means of fastening whatever. These latter should be of such a nature as would require complete detachment from the doors when opened, whereby any accidental obstruction from unintentional fastening would be entirely avoided.

Will the frightful calamity which has just befallen the northern town, be the means of effecting any large measure of reform? We fear not. It is really astounding when we come to investigate such matters, how much evil consequence must be brought about in the world, how many precious human lives must be lost, before the most obvious mistakes get rectified. Verily the race is slow to learn in some things although so quick in others.

True we have resulting a small Bill introduced into the House of Commons, which proposes to make it "compulsory on all constructors of public buildings that doors should be hung so as to open outwards." We most earnestly commend to the notice of Mr. KENNARD, the various suggestions we have made in the foregoing remarks, and trust that something more will be insisted upon than the mere manner of hanging doors, important as this may nevertheless be.

In conclusion we desire to express our satisfaction that some attempt, however slight, to deal with this evil, is to be made, and to hope that when the Bill gets into Committee, additions may be made which will effect a real change in the construction of all new buildings, and compel a reasonable modification in existing ones.

W. G.

Proceedings of Societies.

ROYAL SOCIETY.

JUNE 7.—The Treasurer in the chair.—The annual meeting for election of Fellows was held, and the fifteen named were duly elected: Surgeon-Major J. E. T. Aitchison, Dr. J. C. Browne, Surgeon-Major G. E. Dobson, Dr. J. M. Duncan, Prof. G. F. Fitzgerald, W. Flight, Rev. P. Frost, Dr. D. Gill, C. E. Groves, H. Grubb, J. N. Langley, A. W. Reinold, R. Trimen, J. Venn, and J. J. Walker.

GEOLOGICAL SOCIETY.

MAY 9.—Mr. J. W. Hulke, President, in the chair.—The Rev. W. Spiers and Mr. H. A. Williams were elected Fellows.—The following communications were read: "The Age of the Newer Gneissic Rocks of the Northern Highlands," by Mr. C. Callaway, with notes on the lithology of the specimens collected, by Prof. T. G. Bonney.—"On a Group of Minerals from Lilleshall, Salop," by Mr. C. J. Woodward,—and "Fossil Chilostomatous Bryozoa from Muddy Creek, Victoria," by Mr. A. W. Waters.

JUNE 6.—Mr. J. W. Hulke, President, in the chair.—Mr. G. Paul was elected a Fellow.—The following communications were read: "The Estuaries of the Severn and its Tributaries, an Inquiry into the Nature and Origin of their Tidal Sediment and Alluvial Flats," by Prof. W. J. Sollas,—"Notes on a Collection of Fossils and Rock Specimens from West Australia, North of the Gascoyne River," by Mr. W. H. Hudleston,—and "Notes on the Geology of the Troad," by Mr. J. S. Diller, communicated by Mr. W. Topley.

BRITISH ARCHÆOLOGICAL ASSOCIATION.

MAY 16.—Mr. T. Morgan in the chair.—A magnificent series of drawings was exhibited by Mr. H. Watling, for the most part facsimiles of paintings still remaining on various rood screens in Norfolk and Suffolk, some being of saintly personages and others of celebrities of the fourteenth and fifteenth centuries. Fourteen or fifteen of the drawings were illustrative of St. Edmund, king and martyr, there being many representations of him in East Anglia, either in fresco painting or in stone or wood carving. Mr. L. Brock exhibited a series of Roman pottery found in London, showing almost all the varying descriptions of fictile ware found in the metropolis, which are very numerous, brought from other parts of the country and from the Continent. Mr. W. Anderson described a gold ring found on Flodden Field, having the peculiar chasings which have been noticed on other rings found on this site. Mr. G. Dawson exhibited a fine-bronze celt found at Bo-Peep, St. Leonards. Dr. Frier reported a great number of inscriptions on ancient bells in German churches, having many points of resemblance with similar examples in England. One recorded the melting of the bell by lightning, notwithstanding the old belief that the sound of bells would quell a tempest. The Rev. ——— Worthington described his discovery and restoration of the fine early cross in the churchyard of St. Teath, Cornwall. The first paper was by Dr. Davidson and Mr. W. de Gray Birch, on various unedited charters relating to Exeter Cathedral, St. Mary, Crediton, St. Patrick, Bodmin, and St. Germans, Cornwall. These are now exhibited in the museum at Exeter. They illustrate a very early period of West-country history, and are of great value to historical students. Photographs of all the documents were exhibited, and transcripts will appear in the Society's *Journal*. Mr. G. R. Wright described the ancient walls which have recently been discovered at Hollingbury, near Preston, Brighton, on land described in old deeds as "Anne of

Cleeve's land;" Roman pottery and other relics of the same date have been found with the walls. An elaborate paper was then read by Mr. W. Henderson on the restoration of the ancient church of St. Mary, Ashford Carbonel, a building of early Norman date, enlarged to the east and the west in twelfth century times. Many interesting discoveries have been made. The proceedings were brought to a close by a *resume* of the results of the recent visit to London of some of the country associates, read by the Chairman.

NUMISMATIC SOCIETY.

MAY 17.—Dr. J. Evans, President, in the chair.—Mr. G. White was elected a Member. Mr. J. G. Hall exhibited a selection of mediæval coins of various countries with a seated figure for type. Mr. J. W. Trist exhibited a medal struck in Holland in 1579, referring to the execution of Counts Egmont and Horn. Mr. H. S. Gill exhibited a counterfeit sterling of William, Count of Namur.—Canon Pownall exhibited two medals of Pope Callixtus III., signed by an engraver G.P., thought by him to stand for G. Paladino. One of the medals recorded a naval victory over the Turks. Sir H. Lefroy communicated an account of the discovery of a new denomination of the Bermuda hog-money, of the current value of threepence. A paper by Sir H. Lefroy was also read on a curious expedient adopted in the early part of the present century in New South Wales for making the Spanish dollar, worth 4s. 2d., do duty for 6s. 3d. This was effected by punching out a disc from the centre, which passed for 1s. 3d., and boldly stamping 5s. on the annular portion left. These coins, popularly called "holey dollars," are now very scarce. Specimens both of the disc (inscribed FIFTEEN-PENCE) and of the outside ring (inscribed FIVE SHILLINGS) were exhibited by Mr. F. W. Pixley. Mr. H. S. Gill read a paper on seventeenth century tokens of Hampshire not described in Boyne's work. Mr. E. H. Bunbury communicated a paper on the coins of the Seleucidae. Mr. B. V. Head gave an abstract of a paper by M. de Lacouperie on the date of the introduction into China of the abacus, or calculating board, called by the Chinese *su-an-pan*.

CHEMICAL SOCIETY.

MAY 17.—Dr. W. H. Perkin, President, in the chair.—Capt. W. de W. Abney delivered a lecture "On Photographic Action studied Spectroscopically." The lecturer said he wished that all chemists were photographers; photography occupied the borderland between chemistry and physics; he was firmly convinced that photographic action was interatomic. The action of a developer was then experimentally illustrated. This action is physical; light causes the liberation of iodine in a film of silver iodide, and the developer precipitates metallic silver; the silver so reduced is infinitesimal, and must be in many cases derived from the film. The positive pole of the electric arc was found to be the best source of light. Gratings could not be used for quantitative work as they varied so much in their ruling. A glass prism was, therefore, used to form the spectrum. A film of silver chloride absorbs only the violet end of the spectrum; silver iodide absorbs more, and the bromide most of all; accordingly, when a photograph of the spectrum was taken on these three films it was seen that the portion of the chloride acted upon was very much less than when bromine of silver was used. It was shown that a sensitizer essentially takes up the halogen liberated by the action of light. One salt of silver may act as a sensitizer to another salt of silver. Photographic action is completely prevented by the presence of oxidizers, as bichromate, &c. Reverse photographs were discussed, and the

action of sodium sulphite in preventing the evil effects of over-exposure. The peculiar green condition of silver bromide, which is sensitive to ultra-red rays, was explained. In conclusion, the lecturer said that his principal object was to warn chemists of some of the numerous pitfalls which they might encounter in scientific photography.

INSTITUTION OF CIVIL ENGINEERS.

MAY 22.—Mr. Brunlees, President, in the chair.—The papers read were: "On the Edinburgh Waterworks," by Mr. A. Leslie.—"On the Waterworks of Port Elizabeth, South Africa," by Mr. J. G. Gamble.—and "On the Water Supply of Peterborough," by Mr. J. Addy.

HISTORICAL SOCIETY.

MAY 19.—Mr. J. Heywood in the chair.—Mrs. Jervis, Rev. W. Morris, Messrs. S. W. Beck, W. Howarth, J. Jackson, and R. W. Moore were elected Fellows.—Sir Bartle Frere read a paper "On the Materials for a History of Temperate South Africa." He said that although the history of South Africa did not go back with any degree of accuracy to a very remote period, a careful study of it would lead to the discovery of reasons for many of our present troubles, and, what was still more important, the discovery of the way out of them. Throughout the country three great families of the human race had preceded the arrival of Europeans; the Bushmen, the Hottentots, and the Kaffirs. There were, however, traces of prehistoric man in the shape of stone walls, flint implements, hand-made pottery, &c., found in the caves and gravel deposits of the country. The historical period began with the writings of the Greek geographers, especially Strabo; but the first people from whom we gained much information were the Portuguese, who, however, tell us little about the people. The Portuguese were followed by the Dutch, whose occupation of the country was purely commercial, and in no way intended as colonization. The first occupation by the English was in 1795, when Admiral Elphinstone entered Table Bay and demanded the surrender of the colony in the name of the Stadtholder, then a fugitive in England. After being given up to the Batavian Republic at the Treaty of Amiens, the Cape was again taken in 1806 by Sir David Baird, and finally ceded to England in 1815 by the Treaty of Paris. The statements of the commanders of those days would prove very instructive to those who now contend that we should hold the place as a second Gibraltar. There were good materials for a history of the Dutch occupation, but the English was to be gathered chiefly from Blue-books.—A discussion followed, in which Miss A. M. Buckland, Messrs. Hyde Clarke, Hurst, Pagliardini, and C. Walford took part.

SOCIETY OF ANTIQUARIES.

JUNE 7.—Mr. John Evans, V.P., in the chair. This being an evening appointed for the ballot, no papers were read.—The Chairman called the attention of the Society to the rubbings from foreign brasses by the Rev. F. M. Creeny, which were still on view, and to Mr. Creeny's intention to reproduce them by photo-lithography, or some kindred process, in a volume, for which he hoped to secure one hundred subscribers.—The following gentlemen were elected Fellows: Messrs. F. J. Methold, A. Peckover, G. Metcalfe, J. B. Davidson, M. Burrows, and C. I. Elton.

ARCHÆOLOGICAL INSTITUTE.

JUNE 7.—The Rev. F. Spurrell in the chair.—Before proceeding to the business of the meeting, the Chairman mentioned the death of Capt. E. Hoare, an early member of the

Institute and a constant attendant at the meetings.—The Rev. J. Hirst read a paper "On the Native Levies raised by the Romans in Britain." This was a vindication of the list of native troops recruited by the Romans in Britain—and sent by them, according to custom, out of the country to act as auxiliaries to the legions on foreign service—which was first given by Dr. de Vit, a Roman archaeologist of some note. The author showed conclusively that the small list of one cohort of foot soldiers and one wing of horse, technically styled *Britannica*, which is the utmost hitherto admitted by English writers on the subject, such as Camden, R. Smith, and Sadler, was utterly inadequate, and, moreover, misleading, as they embodied in their total of native levies troops which, according to Hubner, McCaul, C. Bruce, Rhys, T. Watkin, and De Vit, were raised amongst a continental race of Britons, the existence of which is admitted by the late Dr. Guest in his posthumous work "Origines Celticae." The paper, moreover, treated of the probable total of British levies and of the position they occupied in the latter age of the Empire. Here the authority of Lingard and of the Saxon chroniclers was called in question, and a vivid picture was drawn of the effect of the ruthless pressgangs of the Romans and of the change wrought in the habits of the natives by the enervating influence of Roman civilization.—Mr. Waller made observations on the early brasses in Cobham Church, rubbings of which were exhibited by Mr. W. Wilmott.—Mr. Walford offered some remarks upon a portrait of Dr. Johnson, which had lately come into his possession, and which was exhibited. This was shown by Mr. Waller to be a copy, and not the work of Sir Joshua.—Mr. F. Potts sent two little silver statuettes of St. James of Compostella in the habit of a pilgrim and St. Bartholomew bearing his skin in the usual manner. These appeared to belong to the end of the seventeenth century and to have been affixed to a *chasse*.—Mr. O. Morgan sent a set of drawings, made some years ago, of the ancient clocks at Rye, Dover Castle, and Wells.—Mrs. Jervis laid before the meeting some books and MSS.—Mrs. Kerr sent photographs of human remains lately found at Pompeii.—Mr. Hartsorne exhibited a box with scales and weights, early seventeenth century, for goldsmiths' use.—and Mr. E. Peacock sent a bronze mortar decoration with arabesques from his interesting collection of such objects.

LINNEAN SOCIETY.

JUNE 7.—Sir J. Lubbock, Bart., President, in the chair.—Mr. R. J. Clarke and Mr. F. Matthews were elected Fellows.—Mr. W. T. Thiselton Dyer exhibited a series of copals, some from Inhambane, near Mozambique, the product of *Copaifera gopshiana* of various sorts, with a melting-point from 310° to 360° Fah.; others from Lagos (obtained by Capt. Moloney), used by the natives for burning, and powdered by the women as a body perfume. The last are supposed to be from a species of *Daniellia*, the native name being "ogea."—Mr. Hiern drew attention to specimens of *Quercus ilex* var. *fordii* from Barnstaple, Devon, showing remarkable alteration in the leaves after pruning.—There was exhibited for Mr. S. R. Rake, a burdock leaf with numerous excrescences, supposed to be the result of insect irritation.—Mr. G. Murray exhibited specimens of lace killed by the fungus disease (*Saprolegnia ferax*), the result of inoculation, and said to be the first experimental proof of the communicability of the disease to these fish.—Prof. T. S. Cobbold showed shrimps sent by Dr. Burge, of Shanghai. They contained immature flukes, which it was thought might prove to be the larval state of one or other of the three species of human fluke known

to infest man in Eastern countries. He proposed to call the parasite *Cercaria burgei*.—A paper was read by Mr. H. N. Ridley, "On new and Rare Monocotyledonous Plants from Madagascar," among which may be mentioned species of *Drimys* hitherto only known from Africa; several curious orchids, one remarkable for possessing only one or two very large and handsome green, white, and purple flowers; and of Cyperaceæ, one form well known as an Indian plant, another of the genus *Fintelmannia*, supposed to be confined to Brazil. He also describes a new genus, *Acriulus*, allied in some respects to *Crystangium*.—A communication was read from Mr. G. Lewis, "On Japan Brentidæ and Notes of their Habits." These beetles form part of the collection made by the author in his visit to Japan during the summers of 1880-81. He observes there is no geographical barrier sufficient to exclude tropical form from Japan, but their environment when they reach it prevents them from establishing themselves to any great extent, at least in the northern parts. In the southern islands of the Japanese archipelago the warmer climate enables a fair number of beetles of a truly tropical type to exist. The fact that each genus is only represented by one species nevertheless points to some physical check in their spread and numbers. A new genus, *Higonius*, is characterized, and several species of this and other genera are described and illustrated.—Mr. T. H. Corry read a paper "On the Fertilization of the Asclepiads," chiefly bearing out views noticed on a former occasion.—A short record of observations on the white ants (Termites) of Rangoon, by Dr. R. Romanis, was read by the Secretary. In this details are given of what he saw during the swarming of a nest.

CHEMICAL SOCIETY.

JUNE 7.—Dr. Perkin, President, in the chair. The following papers were read: "Laboratory Notes," by Messrs. J. H. Gladstone and A. Tribe: 1. On the action of light and heat on cane and invert sugars. 2. On hydroxylamine; the copper zinc couple reduces this substance, ammonia being formed. 3. On the recovery of iodine from organic iodide residues; the residues are poured on to an excess of the couple, and the iodide of zinc formed, extracted with hot water; iodine is obtained in the free state by the action of hydrochloric acid and bleaching powder on the iodide. 4. A residual phenomenon of the electrolysis of oil of vitriol; the formation of Berthelot's persulphuric acid was noted. 5. On an alleged test for alcohol: Davy suggests that alcohol can be detected by the blue colour produced with a warm solution of molybdic anhydride in oil of vitriol. The authors find that other reducing substances and sugar give the same reaction. 6. Reaction of the couple on nitric oxide: ammonia is formed, but no protoxide. 7. On the reducing action of spongy lead.—"Note on a Basic Ammonio-Copper Sulphate," by Mr. S. U. Pickering.—"Notes on Loew and Bokorny's Researches on the probable Aldehydic Nature of Albumen," by Mr. A. B. Griffiths.—"Note on the Action of Sulphuric Acid, sp. gr. 1.84, upon Potassium Iodide," by Mr. H. Jackson.—"The Action of Nitrous Anhydride on Glycerine," by Mr. O. Masson.

GARNETS.

THE colour of the garnet is blood or cherry red; when mixed with blue it passes into crimson and violet red, and when tinged with yellow into hyacinth red; it is also met with of a reddish brown colour, liver-brown, and black, also greenish black. It occurs in mass disseminated, in angular fragments, or crystallised. Its primitive figure is the rhomboidal dodecahedron, which, when somewhat lengthened, presents the appearance of a

short six-sided prism, the faces of which are parallelograms terminated by trihedral summits with rhomboidal faces. Sometimes the original faces of the dodecahedron entirely disappear, and the result is a solid bounded by 24 equal and similar trapeziums. Sometimes all the sides of the primitive dodecahedron are replaced by lengthened hexagons, whence results a solid bounded by 12 rhombs and 24 hexagons. Other more complicated figures, but which cannot be rendered intelligible by mere description, originate from the mixture of the two preceding modifications. The size of the crystals is subject to great variations. Some are no larger than a pin's head, while others are four inches or more in diameter. The external lustre is casual, but generally glistening; the internal lustre is bright-shining, vitreous. Its fracture is perfectly conchoidal, passing into imperfectly conchoidal, coarse grained, uneven, or splintery. Its fragments are indeterminate angular and sharp edged. It sometimes occurs in granular or lamellar distinct concretions. It varies from transparent to translucent on the edges. Its hardness is superior to that of quartz. Its specific gravity is from 3.7 to 4.2.

It is often magnetic, and is fusible without much difficulty before the blowpipe into the black enamel. When strongly heated in a charcoal crucible, it affords a gray dusky glass full of grains of iron, often amounting to 10 or 12 per cent.

This mineral has been repeatedly analysed by Klaproth, Vauquelin, and other able chemists, but without much agreement in the results; and as in general the same method of analysis has been adopted, the remarkable differences which have occurred can only be attributed to a real variation in its composition; they all agree, however, that it contains a large proportion of iron, and possibly this ingredient may be the one which principally influences its crystallisation.

The Bohemian garnet has been analysed by Klaproth, with the following results:—Oxide of iron, 16.5; oxide of manganese, 0.25; silice, 40; alumina, 2.58; lime, 3.5; and magnesia, 10. Vauquelin's analysis of the same stone gives the following:—Oxide of iron, 21; silice, 36; alumina, 22; and lime, 3. The Sirian garnet, according to Klaproth, contains: Oxide of iron, 36; oxide of manganese, 0.25; silice, 35.75; and alumina, 27.25. The most beautiful and valuable garnets are the oriental. They come principally from Pegu; and the town of Sirian having been formerly the chief mart for them, they are hence by corruption known among lapidaries by the appellation of Sirian garnets. They appear to be the carbuncle of the ancients; their colour is crimson, verging into a very red violet; they are transparent, and have a conchoidal fracture. Of their geological situation we are entirely ignorant. Next in estimation to the oriental is the Bohemian garnet. It is met with in the Mittelgebirge of Bohemia and in Saxony; its colour is blood red, verging into yellow; it never occurs crystallised, but only in rounded and angular grains; it is transparent, and its fracture is conchoidal. It occurs in float-trap and in alluvial land, formed by the decomposition of this class of mountains; it is also met with in serpentine.

Common garnet occurs almost always in primitive rock, especially in micaceous schistus; chloritic slate, and serpentine; it is sometimes so abundant as to constitute the principal part of the rocky mass in which it is found, which is then an excellent flux for iron ores on account of its fusibility and the large quantity of this metal which it contains.

The oriental and Bohemian garnets when cut and polished are very beautiful, and were formerly (particularly the first) in high estimation, but by the caprice of fashion their employment, and consequently their value, have since much declined.—*Glassware Reporter*.

HYPNOTISM IN PARIS.

THE difference between M. Donato's performances and the experiments of Drs. Charcot and Dumontpallier is this: The subjects for experiment by the latter gentlemen were exclusively female patients more or less hysterical, and those exhibited by M. Donato were almost exclusively young men, presumably healthy. This fact, he says, shows the greater magnetic power he possessed over those who experimented on females only; and if he had a subject of the fair sex who accompanied him in all his performances, it was for the sake of convenience, so as to have a subject always at hand.

M. Donato's subjects should, according to his own admission, be naturally very sensitive to the magnetic influence, or they should at any rate go through some preparation, or rather training, before they could be considered fit subjects. Would this of itself not imply a certain degree of *comperage*? As far as I have seen, the young men are a pale, nervous, delicate looking set, and are generally shopmen or clerks; and they are always, or nearly always, the same subjects who go through these demonstrations. I have seen them not only go through all the feats described by M. Charcot with his female subjects, but they seemed to be entirely under the influence of his will—so much so, he had only to will certain things and he was implicitly obeyed without even touching his subjects.

For instance, he prevented them, while in the magnetic state, from opening their eyes or their mouths, or from speaking in an audible tone, rising when once on their knees, or from giving a blow with the fist while the arm was placed in such an attitude, notwithstanding the strenuous efforts made by the subjects to put these acts into execution. But what is most wonderful is, the magnetizer could get them to do certain things which are directly opposed to his verbal injunctions, but are strictly in accordance with his will. Thus, in spite of the repeated orders, which he delivers in the most imperative manner, to open their eyes, their mouths, to pronounce words suggested by their magnetizer, they do just the reverse, and remain silent simply because he wills it inwardly.

In some cases, if the subject is magnetized in the midst of a song, he suddenly stops, and resumes it when he is awakened, just at the phrase or the portion of the word where he had left off. Even the special senses are in the power of the magnetizer, which he can alter at pleasure. For instance, one of the subjects magnetized thought he was enjoying an apple while he was eating a raw potato. The mental faculties of the subject are not less under the control of the magnetizer, for he suspends his memory at will; the subject forgets the most common circumstances and the names of articles of everyday life; indeed, he forgets his own name and even the sex he belongs to. Fortunately this "*lapsus memoriæ*" lasts only during the magnetic sleep, from which he is roused by a slight whiff in his face.

What will partisans of cerebral localization say to this, and what will pathologists say when they are informed that phenomena such as those described above, which are the result of certain diseased processes of the brain, all of which are of a complex nature and take time to effect their work, are here produced, cured, and reproduced in a few minutes and at the will and pleasure of a "magnetizer?" I ask whether such phenomena can be *bona fide*, even when produced by a man of science? It would seem naive to put such a question, but when I think of the remarks that were made in my hearing at M. Donato's performances, and by men of science, who expressed their belief in the reality of what they had witnessed, and when one takes into consideration the amount of credit obtained for these pseudo-scientific representations through the

medium of articles published on the subject in certain periodicals, it seems time that something should be done to expose the fallacy and danger of a doctrine according to which a magnetizer, expert in the art, could command at will the execution of any crime by a subject in the magnetic state. But truth will always prevail, and the impostures, misconstructions, and misrepresentations are, by the more discerning portion of the public, separated from it as the chaff is from the wheat.

This is what has happened to M. Donato's magnetic *seances*, which were found to be all "chaff," mixed up with a semblance of science, as was shown by a certain number of anti-magnetizers, who had got up opposition meetings. Among others, I may notice one convened by M. Carmelli, Professor of Mathematics at a government college, who, finding his pupils so full of M. Donato's experiments on animal magnetism, which diverted them from their studies, determined to prove by practical demonstration that the whole affair, whether it be called animal magnetism or hypnotism, was a monstrous humbug. This the anti-magnetizer had not much difficulty in doing. The meeting was announced beforehand, and of course the hall was crowded.

At the hour appointed M. Carmelli made his appearance in due form in evening dress, and accompanied by a Mademoiselle Mariani his "*sujet de demonstration*," as M. Donato had his, and who was named Mademoiselle Lucile. M. Carmelli began by assuring his audience that he had never been magnetized in his life, and consequently did not possess the mysterious agent called the magnetic fluid. He would, however, undertake to put Mademoiselle Mariani, who also had never been magnetized in her life, through the same processes that M. Donato's subject was in the habit of going through.

After a few passes over the forehead and head, a few insignificant looks, and other manoeuvres usually employed on such occasions, Mademoiselle Mariani fell off into a state of catalepsy. She was then placed on a chair, her body being as rigid as a corpse, with her eyes wide open and fixed, from which even the burning of a bundle of phosphorus matches under her nose did not rouse her; there was not a quiver in the muscles of the face, and she looked as white and as lifeless as a marble statue. To show how completely she was under his control, the magnetizer roused her by a few passes, and then by certain other passes, she fell back again into the cataleptic state. A medical man who was present observed that he had seen all this gone through at the Salpêtrière except the burning of matches, which would be too vulgar a trick for that institution, and he thought that the subject herself, who looked highly hysterical, might have been a patient in that hospital.

While in the cataleptic state her eyes were blindfolded, and she went through the usual tricks as cleverly as any somnambulist by profession. After a short rest and a few fresh passes she again fell off into a sleep. The magnetizer then drove a long pin through the fleshy part of the forearm, but she did not flinch, and not a drop of blood was seen oozing from the wound. She was then placed in the horizontal position between two chairs, her head resting on one and her feet on the other, with nothing to support her back. In this position the magnetizer sat, and even stood upright on her, and she lay as inflexible as a board under the man's weight. This brought down a thunder of applause from the assembly, but it having been intimated to M. Carmelli that it was impossible for any person, not under the influence of magnetism, to go through such a feat as Mademoiselle Mariani had just gone through, he simply reminded his audience that it was a feat commonly performed by clowns at circuses and public fairs, who certainly had no pre-

tensions to magnetism; and in order to prove that neither somnambulism nor magnetism had anything to do with it, he proposed rousing his subject from her feigned sleep, and that without any passes or blowing on the head, or even touching her. By the simple word of command, "*Mademoiselle, levez vous*," she showed signs of gradually coming to by first smiling, and then, stretching out her limbs, she sprang to her feet, and looked none the worse for all she had gone through.

He then explained the trick of passing long needles or pins through the arm without pain, and that it was not necessary to be magnetized to escape suffering, and, suiting the action to the word, he turned up his sleeve and passed a long pin through his own arm. He declared he felt no pain whatever, and invited anyone in the assembly to come forward and try the experiment for himself or herself. No one seemed inclined to attempt it until an old gentleman offered his services, and M. Carmelli put him through the same process as he had just gone through himself, the old gentleman also declaring that he felt no pain whatever. This was the acme of Carmelli's success, and before bringing the *seance* to a close he wished to impress upon the assembly that there was no such thing as animal magnetism, that there was certainly an understanding between the magnetizer and magnetized, and that it required some dexterity in performing the tricks and the most scrutinizing attention to detect them.

As for the feat of thrusting a long needle or pin through the arm, it was a very common one, and the explanation given as to the painlessness and bloodlessness of the operation was that the parts generally selected were those barely supplied with nerves and blood vessels of any size, as is the case of the upper and fleshy part of the forearm. Besides which, it is a fact well known to surgeons that the muscles are not endowed with great sensibility, and the only pain felt, if at all, would be in the skin, but this would be so slight that, coupled with the dexterity of the operation, the subject would hardly feel any. If the subject be hysterical, this would still more favour the success of the feat, as the skin is generally insensitive in this condition; and this would explain how Mademoiselle Lucile bore the operation so well.

This amateur *seance* was most damaging to M. Donato who was present, and just at the termination he stood up, and, in a most frantic rage, denounced his adversary's experiments as unscientific and absurd. Whereupon an altercation took place, not only between the principals, but between their respective partisans. This, however, was soon put down, and at the breaking up of the meeting many of the audience left with the firm belief that M. Carmelli was a magnetizer *incognito*, or, at any rate, that he and his coadjutor possessed the fluid without being cognizant of the fact, or that they had some motive for not wishing to own it, as they both, Mademoiselle Mariani in particular, acted their part too well to have merely simulated.

Be that as it may, M. Donato's glory from that day grew dim and Mademoiselle Lucile began to find out that she had not been properly treated in the division of the profits accruing from the *seances*, and as a natural sequence she quarrelled with her *pro tempore* lord and master and denounced him as an impostor. Moreover, at an interview a journalist had with her she fully exposed M. Donato's tricks, and made some very interesting disclosures. Among other things she told her interviewer that at times she was rather refractory, and could not fall asleep. M. Donato then resorted to the expedient of dosing her with opium, which made her feel so drowsy and stupid that he used to pinch her to keep her awake till the proper time arrived. But there were times she was

so sleepy from an over-dose of opium that she could not be roused, and it was then that M. Donato had recourse to the young male subjects already referred to, who were regularly trained to go through the processes told off for them. She further avowed that if she had a choice in the matter she would, by a great way, prefer to have the pins thrust into the arm than be pinched as she was, as the latter operation caused her great pain, and her body was covered with boils in consequence. Nothing has been heard of M. Donato since these disclosures were made, and the rage for exhibitions such as he provided in Paris has consequently declined.

CONSTITUTION OF THE SUN.

In a paper presented to the French Academy (*Comptes Rendus*, xcvi., 136) Faye gives his reasons for believing that our sun and the other large self-luminous heavenly bodies have not yet arrived at either a solid or a liquid state, but are gaseous all the way to the centres. Otherwise, he says, the heat radiated from them would not be so quickly replaced by heat from within, and the surface, consequently, would soon become covered with a solid non-luminous crust.

Cagniard-Latour has, however, proved by means of some very remarkable experiments that a gaseous mass can acquire the density of a liquid without changing its state of aggregation, provided both temperature and pressure are high enough at one time. If, then, the external strata of the solar atmosphere, where all matter is in an elementary or dissociated state, should cool sufficiently for the elements to enter into chemical combination, if the vapours of metallic calcium, magnesium, and silicon, mixed with oxygen there, on cooling should form clouds of lime, magnesia, and silica, for example, these clouds would sink to the interior, where they would again be dissociated, while at the same time they would drive the hotter particles upward, so that an approximately uniform temperature would be maintained until the whole mass had gradually cooled to such an extent as to assume the liquid and afterward the solid state.

Faye bases his hypothesis on the spectroscopic observations of many years, and on Carrington's study of sun spots, which show that the currents are all in zones parallel to the equator, while there are none from the equator toward the pole. Besides this, the flattening of the sun and the slow motion of sun spots near the poles are more easily explained on this hypothesis of Faye than on those hitherto in vogue.

GOD IN NATURE.—In a recent scientific lecture Professor C. A. Young, the astronomer, of Princeton College, used the following language:—"Do not understand me at all as saying that there is no mystery about the planets' motions. There is just the one single mystery—gravitation—and it is a very profound one. How it is that an atom of matter can attract another atom, no matter how great the disturbance, no matter what intervening substance there may be; how it will act upon it, or at least behave as if it acted upon it, I do not know, I cannot tell. Whether they are pushed together by means of an intervening ether, or what is the action, I cannot understand. It stands with me along with the fact that when I will that my arm shall rise, it rises. It is inscrutable. All the explanations that have been given of it seem to me merely to darken counsel with words and no understanding. They do not remove the difficulty at all. If I were to say what I really believe, it would be that the motions of the spheres of the material universe stand in some such relation to Him in whom all things exist, the ever-present and omnipotent God, as the motions of my body do to my will—I do not know how, and never expect to know."

A MEDICAL OPINION OF THE ELECTRIC LIGHT.

BEFORE the electric light becomes, as it must soon become, the common illuminating agent of the period, says the *Lancet*, a determined effort should be made to devise some mode of mitigating its peculiarly unpleasant intensity. The vibratile impulse of the electric force is obviously stronger than the delicate terminal elements of the optic nerve in the retina can bear without injury. We are wont to apply the adjectives "hard" and "soft" to light, and their significance makes them peculiarly appropriate. The light is too hard; it needs to be softened. The moves of motion are too short, and the outstroke—so to say—joins the instroke at too accurate an angle. This might doubtless be obviated by employing suitable material for globes and shades, but perhaps the best plan would be to break up and scatter the rays of light by reflection. If a small convex reflector were placed immediately below the light in the protecting globe, and one of larger dimensions above it, so as to secure a double reflection with ultimate divergence downward and outward, the effect would be to cause the "rays" of light to fall obliquely on all objects within the immediate area of illumination. This would, perhaps, obviate the need of coloured glasses, which the promoters of the electric light seem to dislike. Certainly there is a considerable sacrifice of power in the use of the opaline globe—so much, indeed, that some of the districts lighted by electricity displayed through this medium do not present any obvious superiority over gas. We throw out the suggestion for what it is worth. Something must be done, for, as it is, the electric light is "trying to the eyes," which means that it is in danger of injuring them, and already, there is reason to believe, mischief has been wrought by its use. For true comfort there is nothing like the light given by the old-fashioned pure wax candle.

GENESIS OF A NEW WORLD.—On a beautiful summer's night, August 22, 1794, Jerome and Lefrançois de Lalande noticed a star in Aquarius, which they estimated of the 7½ magnitude. Six years later they thought it of the 8 magnitude. In appearance it resembles a star which is not exactly in the focus of the telescope. Herschel had observed it in September, 1782, and recorded it as an admirable planetary nebula, very brilliant, small, and elliptical. Lord Rosse and Lassell perceived that it was surrounded by a ring, which gives it somewhat the appearance of Saturn. The spectroscopic observation of Huggins indicate that it is a gaseous mass, in which nitrogen and hydrogen predominate. Most of the other planetary and annular nebulae give similar results. In 1871 and 1872 Brunnow, the Irish Astronomer Royal, measured its parallax and concluded that its distance is more than 404,000 times as great as that of the sun, and its diameter is probably greater than that of the entire solar system. This would make its volume more than 338,896,800,000,000 times as great as that of the earth. We have thus before our eyes a new system, which is probably undergoing the process of condensation through which our sun and its attendant planets passed hundreds of millions of years ago.—*L'Astronomie*.

CARBONATE OF SODA AS A RESIDUE.—L. Faucheux, in the *Moniteur Scientifique*, mentions an improvement in the alkali manufacture which he has devised. He uses as raw materials salt cake and coal, and obtains as products caustic soda, carbonate of soda, and pure sulphur. He has no refuse to remove, and the plant of a Leblanc works will require but little alteration. He gives, however, no particulars.

A NEW CATTLE DISEASE.

AT a recent meeting of the Southern Counties Veterinary Medical Association, held at London, Mr. G. Fleming, Army Veterinary Inspector, read a paper on a new disease which he had discovered to prevail extensively, chiefly among cattle, in England, and the nature of which has until now been hidden in obscurity. It manifests itself by great enlargement and induration, as well as ulceration of the tongue. It also attacks the bones of the face and jaws, appears inside and outside the throat in the form of tumours, and is very destructive, especially among young stock. Mr. Fleming, by means of morbid specimens from the tongues and heads of calves, as well as by microscopical preparations, clearly demonstrated the affection to be due to the presence of a minute fungus, which probably obtains an entrance to the tissues either through the mucous follicles or an abrasion in the mouth. From the peculiar manner in which the fungus grows, and the radiating arrangement of its branches, it has received the name of *Actinomyces*, and it is consequently proposed to designate the disease *Actinomyces*. It has hitherto only been noticed in Germany and Italy, and no fewer than sixteen cases are reported in the German medical journals as having been observed in man. Mr. Fleming produced some evidence to show that the fungus could be successfully implanted from a diseased to a healthy animal; and one of the German cases, in which a man was affected, would lead to the suspicion that it may be communicated from the lower animals to our own species. Instances were given in which the microphyte had also been found in pigs, goats, a horse, and a dog.

BITING HORSES.—Horses have been successfully cured of this vice by putting a piece of hard wood an inch and a half square in the animal's mouth, about the same length as an ordinary snaffle bit. It may be fastened by a thong of leather passed through two holes in the ends of the wood, and secured to the bridle. It must be used in addition to the bit, but in no way to impede the working of the bit. Rarey adopted this plan with the zebra in the Zoo, which was a terrible brute at biting. Mr. Rarey succeeded, however, in taming and training him to harness, and drove him through the streets of London. Animals with this vice should be treated kindly in the stable, and not abused with pitchfork handles, whips, &c. An apple, crust of bread, a piece of beet, &c., and a kind pat, but firm, watchful hand and eye, with the use of the above wooden bit, will cure the most inveterate biter. The fact that he cannot shut his mouth or grip anything soon dawns upon him, and then he is conquered.—*Toronto Globe*.

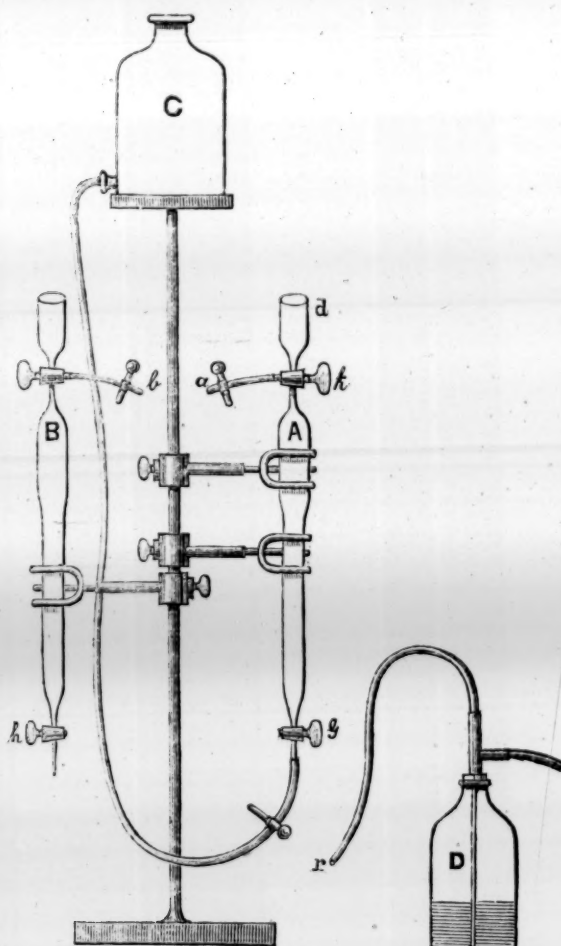
THE COW TREE.—Sir Joseph Hooker, in his report on Kew Gardens, gives a sketch of a most interesting botanical curiosity, the *Palo de vaca*, a cow tree. This tree grows in forests at the foot of certain mountain ranges in Venezuela, and attains a height of 100 feet, and frequently the trunk reaches to 70 feet without a branch. The remarkable characteristic of the tree is the milk which exudes from the trunk when an incision is made. The flavour is of sweet cream with a slightly balsamic taste, but it is very wholesome and nourishing, the composition being said to approach very near the milk of the cow. From the fact that the milk is somewhat glutinous it would seem that the tree is of the caoutchouc order. Seeds which have been sent to Bombay and the colonies are said to be thriving well. It is noteworthy, as an example of the law of compensation traceable in nature generally, that this cow tree seems originally to have been a native of a country where milk-giving animals were formerly totally unknown.

BUNTE'S APPARATUS FOR DETERMINATION OF FURNACE GASES.

By means of this apparatus a ready and sufficiently accurate separation and estimation of oxygen, hydrogen, carbonic acid, carbonic oxide, and nitrogen, may be effected in a comparatively short space of time, thereby supplying to practical men a long-felt want in the determination of furnace gases, and enabling an operator with even a small amount of manipulative skill to ascertain the precise condition of the gaseous contents of the furnaces under his control.

Description of the Apparatus and Directions for Use.

A and B are two burettes fitted with three-way stopcocks, and each graduated in fifths of a cubic centimetre, and capable of holding about 110 c.c.; c, a one-gallon tabulated bottle, serving as a water reservoir; d, a suction bottle used for rarefying the gas subsequent to the introduction of reagents.



Burette A is first filled with water up to stopcock by connection with c, funnel d being also nearly filled. c is then disconnected from A and connection made between A and D; the gas to be examined is now allowed to flow in at a, the water flowing from A to D until nearly empty. Connection is now re-established with c, and water allowed to enter until the bottom graduation is reached; the stopcock k is now carefully turned in order to allow a portion of the gas (which of course is under pressure) to escape through the water in d, until there remains exactly 100 c.c. of gas at the normal atmospheric pressure. The apparatus is now under the proper conditions for analysis of the mixed gases.

Determination of Carbonic Acid.—Tube r of suction bottle is connected with the bottom of the burette, suction applied at n and stopcock g turned, and all the water allowed to run out; g is then closed and r removed; a solution of caustic potash is now applied,

and g being opened, a quantity of the fluid enters; the burette is now taken from its support, the hand of the operator being placed firmly on d, and the gas is well shaken up with the liquid, this operation being again performed if absorption is found not to be complete. When this is effected, the stopcock at k is opened and water allowed to flow down until the normal atmospheric pressure is reached, indicated of course by the water ceasing to flow. The amount absorbed by the caustic potash is now read off = percentage of CO₂.

Determination of Oxygen.—The caustic potash solution is drawn off by means of the suction tube, and an alkaline solution of pyrogallic acid is applied in a similar manner as in estimation of CO₂; if oxygen be present the solution becomes immediately black and the diminution in volume after shaking as before, and reducing to normal pressure, gives the percentage of oxygen.

follows:—The gas is allowed to mix with atmospheric air by turning the cock k, and momentarily releasing the pinch-tap, the water being permitted to flow out at g; normal pressure is then re-established by means of the funnel d, and a reading taken. Connection is now made between a and b, uniting the two by means of a piece of hard glass combustion tubing containing a small coil of palladium wire. Burette B is now filled with water by connection with c. The palladium wire in the tube is brought to a red heat by means of a Bunsen burner, and the gas is caused to pass from A over the heated tube into B by opening h and g, connecting the reservoir water supply c with bottom of burette A. When all the gas has passed over the operation is reversed, the gas being again collected in A. It is allowed to stand until the normal temperature is attained, adjusted for pressure, and read off. It might perhaps be considered advisable to notice here what has taken place in the combustion. The gases remaining in the mixture are hydrogen, carbonic oxide, and nitrogen; by the admixture of air, and passage over the red-hot palladium coil, the oxygen of the air combines with the carbonic oxide (CO) to form carbonic anhydride (CO₂), and with the hydrogen to form water, the nitrogen of course remaining unacted upon. If the gas under examination consist entirely of hydrogen and nitrogen, it is obvious that the diminution in bulk multiplied by two-thirds gives at once the percentage of the former gas; e.g., supposing there to be present 10 c.c. of hydrogen, and 8 c.c. of nitrogen, and 22 c.c. of air have been admitted, the whole therefore measuring 40 c.c.; after combustion the measurement of the gas is found to be 25 c.c., showing loss in bulk of 15 c.c., which diminution is due to the combination of 10 volumes of hydrogen with oxygen 5 volumes, to form water 15 volumes (which latter occupies no appreciable space and may therefore be neglected), consequently $15 \times \frac{2}{3} = 10$ c.c. = vol. of hydrogen.

If carbonic oxide, hydrogen, and nitrogen be present, the calculation is still almost as simple. Supposing, for example, that the following mixture be contained in the burette:—

Carbonic oxide ...	10 c.c.
Nitrogen ...	12 „
Hydrogen ...	8 „

50 c.c. of air are admitted, the whole measuring 80 c.c.; after combustion it is found that measurement is reduced to 80—63=17 c.c.; the 63 c.c. of gases being now submitted to the action of caustic potash solution in the usual manner, the carbonic anhydride produced in the reaction is thereby absorbed, and a further diminution of 10 c.c. observed, which indicates the percentage of carbonic oxide present, since for every volume of carbonic oxide burnt an equal volume of carbonic anhydride is formed; and since also that this 10 c.c. of CO must have consumed half its volume or 5 c.c. of oxygen, we obtain—

$$(17 - 5) \times \frac{2}{3} = 8 \text{ c.c. of hydrogen.}$$

Nitrogen being then calculated by difference.

Panary Fermentation.—The fermentation of bread consists in a transformation of a portion of the insoluble albumenoids of the gluten, first, into soluble albumens, and finally into peptones. The starch is only modified by baking, which forms soluble starch in great quantity, and a little dextrine, the latter especially in those portions which have been most strongly heated. The agent in panary fermentation is a bacterium which is developed normally in the paste, and beer-yeast merely accelerates this development.—*Comptes Rendus.*